Physiology of Fungi

o Fungi are able to withstand certain extreme environmental conditions in comparison with other microorganisms. **For example**, yeasts and moulds can grow in substrates containing concentrations of sugars that inhibit most bacteria, e.g. jams and jellies are spoiled by moulds but not bacteria. **Also,** yeasts and moulds can generally tolerate more acidic conditions than most other microbes. Adaptations such as these are complemented by hydrolytic enzymes secreted into the environment to digest large organic molecules such as polysaccharides, proteins, and lipids into smaller molecules that may then be absorbed as nutrients.

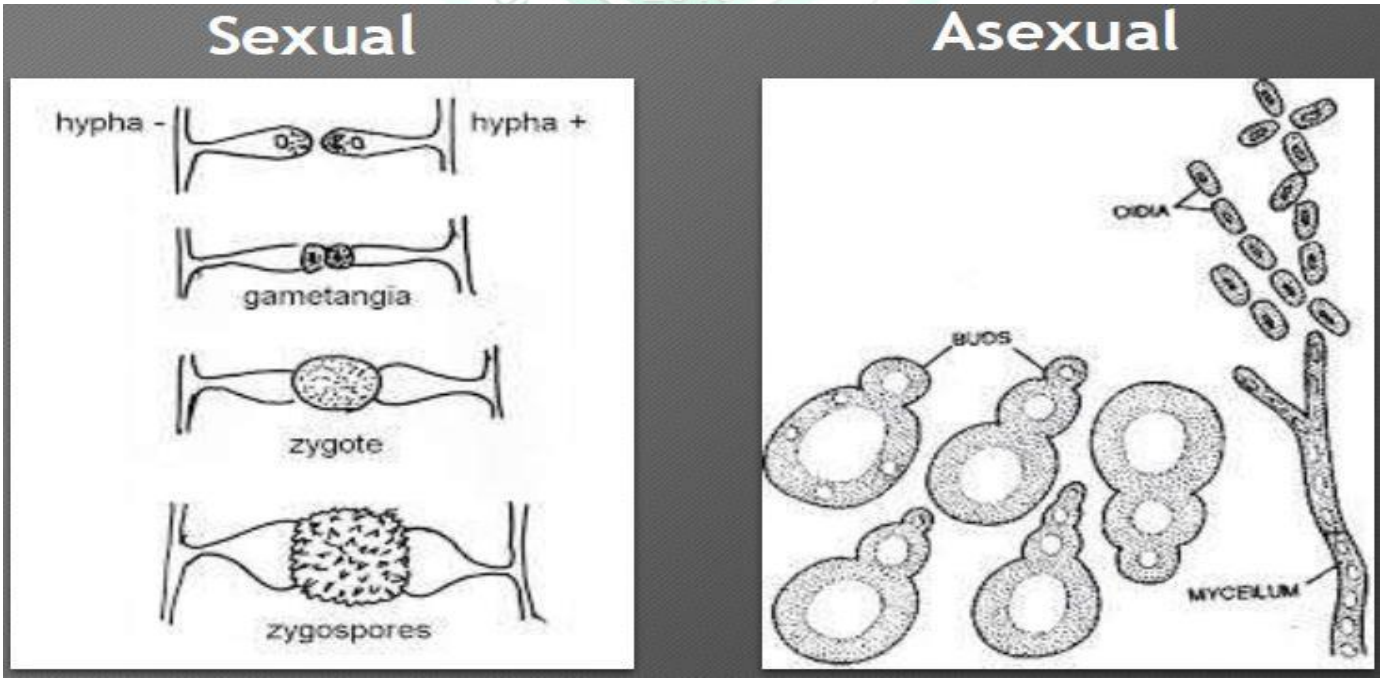
o Fungi grow over a wide range of temperatures, with optimum for most saprophytic species ranging from 22 to 30°C, pathogenic species have higher temperature optimum, generally 30-37°C. Some fungi grow at or near 0°C and thus can cause spoilage of foods (meat, vegetables etc.) in cold storage.

o Fungi are heterotrophic, using a wide variety of materials for nutrition. Some species can use inorganic compounds such as N2 and ammonium salts as source of energy. All fungi can use organic N2 hence culture media for fungi contain peptone.

Comparative physiology of fungi and bacteria.		
Characteristic	**Fungi**	**Bacteria**
Optimum pH	3.8 - 5.6	6.5 - 7.5
Optimum temperatures	22 – 30°C (saprohytes) 30 – 37°C (parasites)	20 - 37 °C (mesophiles)
Oxygen requirement	Strictly aerobic (moulds) Facultative (some yeasts)	Aerobic to anaerobic
Light requirement	None	Some photosynthetic bacteria occur
Sugar concentration in laboratory media	4 - 5%	0.5- 1%
Carbon requirement/ Metabolism	Require organic Carbon	Require Inorganic and/ or organic carbon

I. Reproduction

Reproduction in fungi can be classified into asexual and sexual reproduction



1. Asexual reproduction (Somatic or Vegetative reproduction)

o Does not involve the union of nuclei, sex cells or sex organs occurs

via vegetative spores (conidia) or through mycelial fragmentation.

o Mycelial fragmentation occurs when a fungal mycelium separates into pieces, and each component grows into a separate mycelium.

o Spore formation. Asexual spores, whose function is to disseminate the species, are produced in large numbers. There are many kinds of asexual spores:-

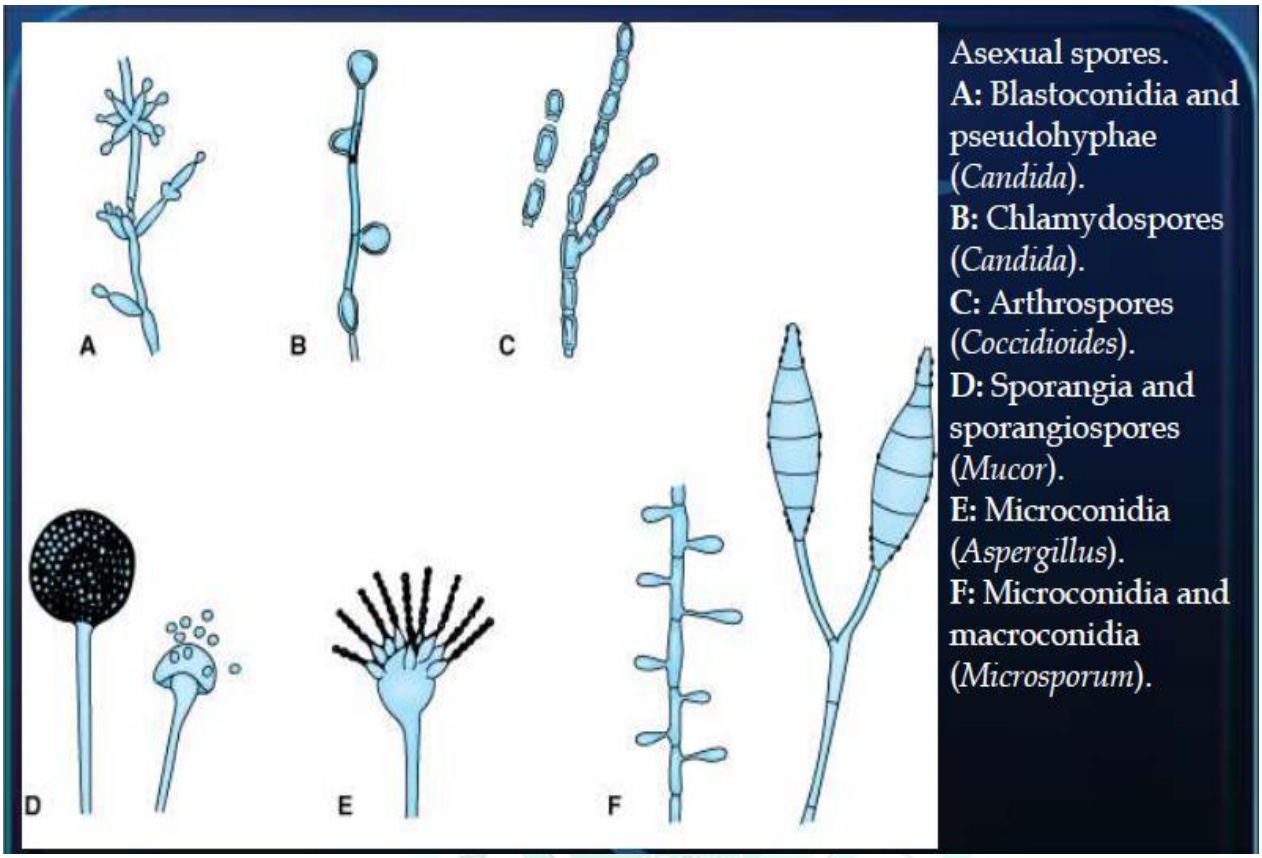
a. Sporangiospores are single celled spores formed in sacs called sporangia.

b. Conidiospores (conidia) are two types; microconidia or macroconidia. Microconidia are small and single celled. Macroconidia are large and multicelled. Shape colour & arrangement of conidia aid in identification of fungi.

c. Arthrospores (oidia) are single celled spores formed by disjoining of hyphal cells.

d. Chlamydospores are thick-walled, single-celled spores highly resistant to unfavourable conditions; formed from cells of vegetative hyphae.

e. Blastospores are spores formed by budding.



2. Sexual Reproduction

Is carried out by fusion of compatible nuclei of two parent cells. The process begins by joining of two cells and fusion of their protoplasts (plasmogamy). This enables the two haploid nuclei of the mating cells to fuse together (karyogamy) to form a diploid nucleus. This is followed by meiosis, which again reduces the number of chromosomes to the haploid number. Fertilisation can be achieved by several processes including:-

a. Planogametic conjugation where plasmogamy (cytoplasmic fusion) involves one or more motile gametes.

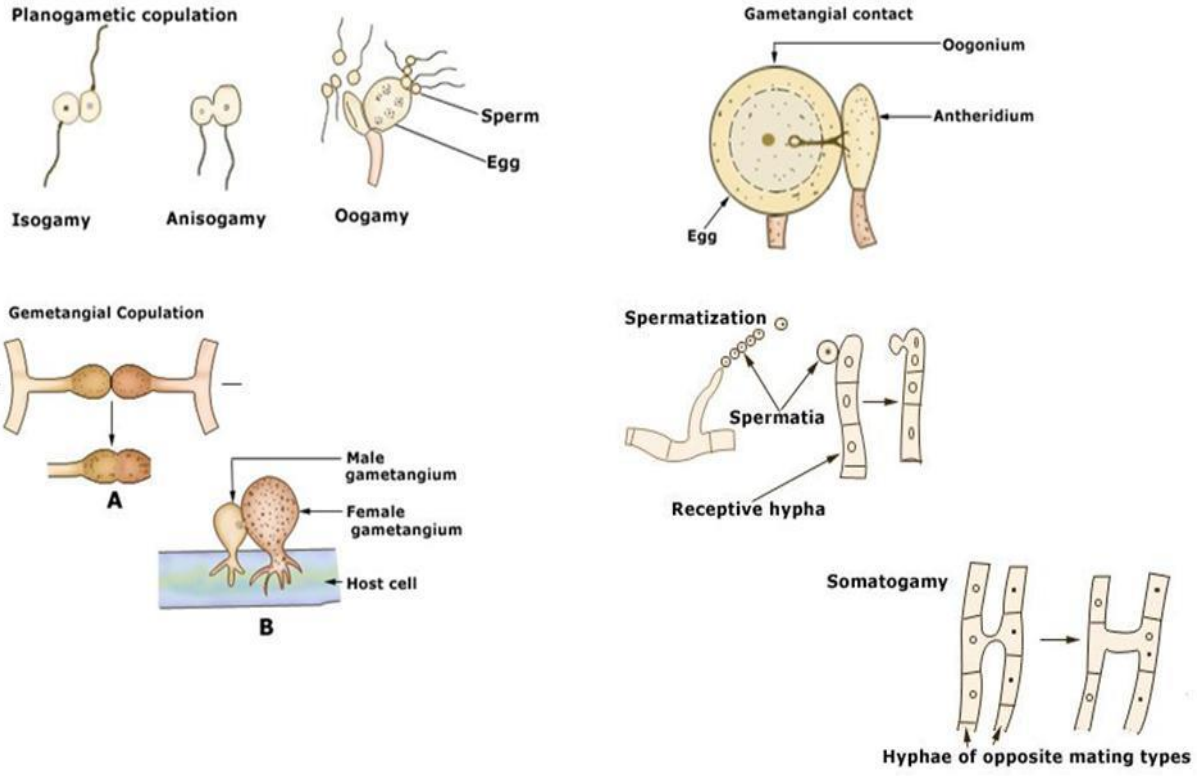
b. Gametangial contact where morphologically dissimilar gametangia (female ascogonia and male antheridia) fuse and the male nucleus passes into the ascogonium through a pore.

Sometimes the ascogonium has a hair-like trichogyne which receives the male nucleus.

c. Gametangial conjugation where plasmogamy (cytoplasmic fusion) is immediately followed by nuclear fusion. No dikaryon is formed. This process occurs in the yeasts.

d. Spermatization occurs in species that do not form antheridia. The male nucleus can reach the ascogonium by fusion of spermatia (non-motile 'sex' cells) with trichogmes, ascogonia or receptive hyphae.

e. Somatogamy where compatible hyphae fuse to form a dikaryotic cell.



Sexual spores which are produced by fusion of two nuclei occur less frequently, later, and in smaller numbers than do asexual spores. The various types of sexual spores include:-

a. Ascospores: single-celled spores produced in a sac called ascus; there are usually 8 ascospores in each ascus.

b. Basidiospores: single-celled spores borne on a club-shaped structure called basidium.

c. Zygospores: large, thick-walled spores formed when the tips of sexually compatible hyphae of certain fungi fuse together.

d. Oospores: spores formed within a special female structure, the oogonium. Fertilization of the eggs or oospheres by the male gametes formed in an antheridium gives rise to oospores.